2003

Maine's Salt Marshes: Their Functions, Values, and Restoration

Michele Dionne

Erno Bonebakker

Kristen Grant
Maine Sea Grant, kngrant@maine.edu

MAINE'S SALT MARSHES:

Their Functions, Values, and Restoration

A Resource Guide

ACKNOWLEDGEMENTS

This resource booklet has been created through the efforts of many individuals who deserve our thanks. Draft review was provided by U.S. Fish and Wildlife Service - Rachel Carson National Wildlife Refuge and Gulf of Maine Program, Grace Bottitta of Ducks Unlimited, John Catena and Eric Hutchins of NOAA Fisheries, Ted Diers of New Hampshire Coastal Program, Fred Dillon of Muskie School of Public Service, Colleen Giordano of Maine Sea Grant, Elizabeth Hertz and Jon Kachmar of Maine Coastal Program, Marilee Lovit, Jon Prichard of University of Maine Cooperative Extension, Dwayne Shaw of Downeast Salmon Federation, Jan Smith of Mass Bays National Estuary Program and John Whiting-Grant. Glossary input was also provided by Grace Bottitta of Ducks Unlimited. Our gratitude is extended to each of these partners.

Text written by:
Michele Dionne, Ph.D., Wells National Estuarine Research Reserve
Erno Bonebakker, Restore Maine's Coast
Kristen Whiting-Grant, Maine Sea Grant and University of Maine Cooperative Extension

Edited by: Susan White, Maine Sea Grant

Publication design and layout by: Cheryl Daigle, Maine Sea Grant

Cover art and fish illustrations by: James Dochtermann

Plant illustrations by: Kristen Whiting-Grant

Photos courtesy of Wells National Estuarine Research Reserve unless otherwise noted.

Support for the printing of this publication was provided by:
Maine Coastal Program, Maine Sea Grant, Pleasant River Wildlife Foundation, Wells National Estuarine Research Reserve, National Oceanic and Atmospheric Administration and Otto Greene, member of the West Branch Study Committee.

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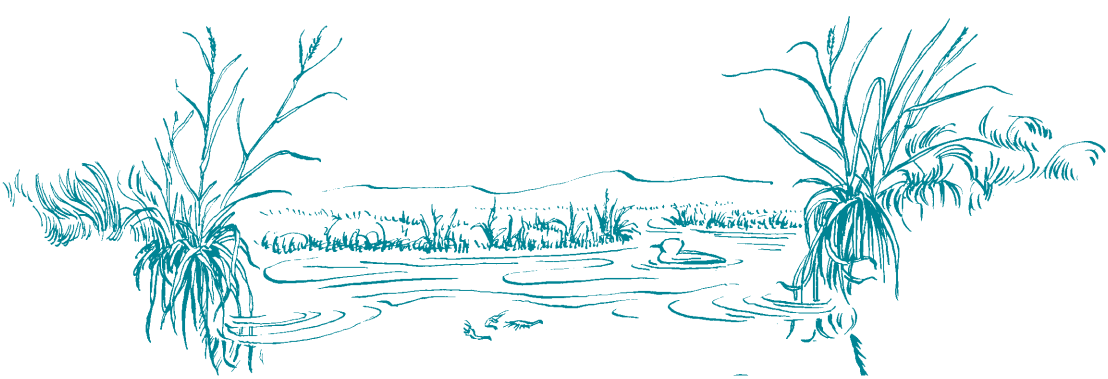


Illustration by Robert Shetterly

WHAT ARE SALT MARSHES?

In the natural world, habitat edges are rich, special places.

Here in the Gulf of Maine, our coastal ***estuaries*** are especially important edges – places where the land meets the sea, mixing fresh and salt water. Estuaries are critical ***transition zones*** between ***uplands***, their ***watersheds*** and the open ocean, providing ***habitat*** linkages for a diverse array of plants, fishes, birds and mammals.

Salt marshes are an integral part of Maine's coastal estuaries—the prairies of New England. They are low lying, open plains of lush grasses in distinct, colorful bands or patches, interwoven with tidal creeks and pools. They result from the interactions of different types of salt marsh plants that flourish in response to specific patterns of tidal flooding. The ability of these systems to thrive is dependent upon the salt marsh's link to the sea. Specialized plants are the foundation of the remarkably productive salt marsh ***ecosystem*** (see indicator species on pages 6-7). Salt marshes are widely distributed in large and small patches all along Maine's tidal shorelines.

Maine's salt marshes have regional character. On the southwest coast, large marshes form meadows behind barrier beaches, similar to marshes in Massachusetts and Connecticut. Farther east, salt marshes occur along the landward edges of protected coves and mudflats, and along the upper reaches of tidal rivers.

WHO NEEDS SALT MARSHES?

Wildlife, finfish, shellfish, baitworms and other forage organisms depend on healthy salt marshes as critical habitat.

Fast-growing salt marsh grass species, called ***Spartina***, form the base of a highly productive ***food web***—more productive than the most fertile midwestern farmland. A diverse ***community*** of mammals, birds, finfish and shellfish use these grasses for food, shelter, spawning, nursery areas and refuge from predators. These ecological functions have tremendous economic value. Two-thirds of commercial fish, shellfish, and bait species (such as striped bass, bluefish, clams, lobster and sandworms) landed in the Gulf of Maine depend on estuaries and coastal ***wetland*** habitat at some point in their life cycles.

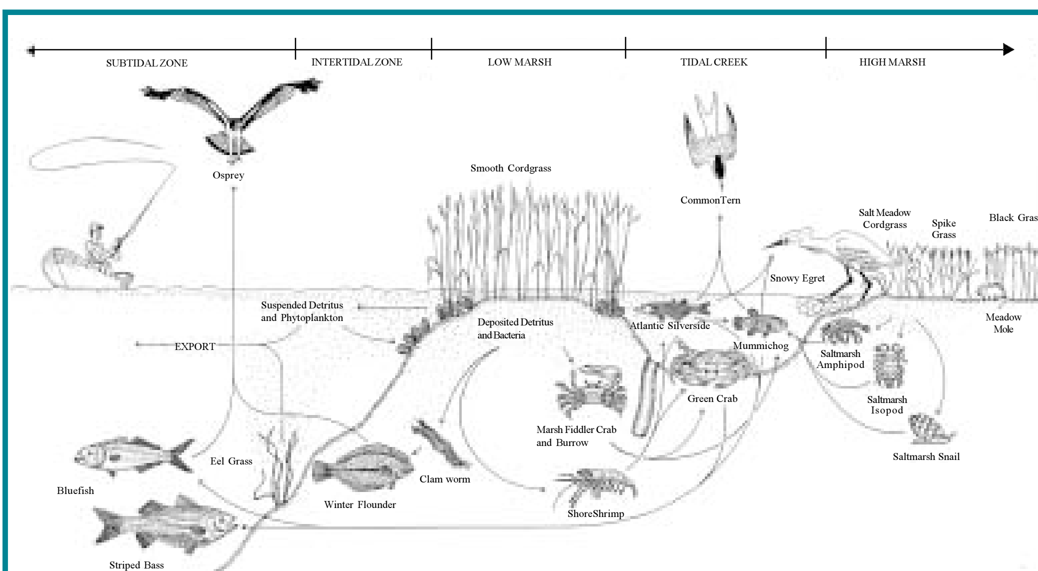
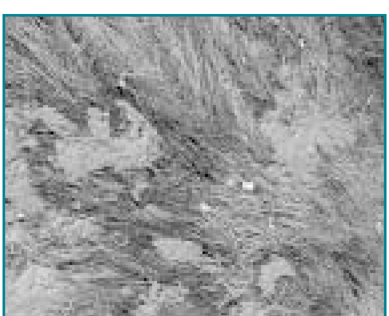


Illustration by Thomas R. Ouellette

People benefit directly from

Erosion Control and Storm Surge Protection:
Peat and sediment buildup in the marsh may maintain the height of the marsh as ***sea level*** rises. Marsh vegetation helps shield the upland from erosion by waves and currents. In addition, the marsh can absorb and moderate much of the impact of floods. Due to the winding channels and dense salt marsh vegetation, the marsh slowly captures and gradually releases flood water.

Educational Opportunities:
The abundant plants and animals of salt marshes make them fascinating field trip and research sites for students of all ages. Since salt marshes represent a relatively simple, well-defined ecosystem, they are ideal natural systems for introducing ecological concepts.



Water Quality Maintenance: As the marsh slows and retains water, it also filters pollutants. Pollutants are often carried by sediment particles that settle and stay buried in the marsh, which limits the pollutants' impact on humans, animals and other ecosystems. Marsh plants can absorb excess nutrients, reducing the likelihood of nuisance ***algal blooms*** in coastal waters.

the ecological functions of salt marshes.

Commercial Value: In the Gulf of Maine, estuaries and coastal wetlands are used by two-thirds of commercially valuable fish, shellfish, baitworms and other forage organisms at some point in their life cycles. The mudflats seaward of salt marshes are exceptional harvesting sites for clams and baitworms. The rivers and streams that meander through salt marshes provide nurseries for juvenile fish, such as winter flounder, Atlantic herring and pollock. The health of salt marshes is of primary concern to those whose livelihoods are tied to the sea.

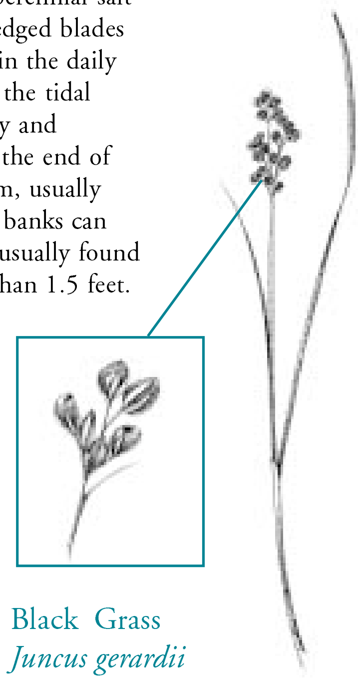
Aesthetic Qualities: A thriving salt marsh is a place of beauty, providing open, green space that increases property values in neighboring communities and enriches the visual landscape for residents and visitors alike. The vivid, seasonally changing colors of salt marshes have inspired artistic expression through the ages.

Recreational Value: Salt marshes provide exceptional sites for hunting, fishing, recreational clamming, boating, canoeing, kayaking and bird-watching. They are also places of peace and serenity for those hoping to reconnect with nature.

SALT MARSH INDICATOR PLANT SPECIES

Cordgrass
Spartina alterniflora

Cordgrass, *Spartina alterniflora*, is a perennial salt marsh grass with long, stiff, smooth-edged blades that taper to a fine point. It is found in the daily flooded ***low marsh*** habitat, closest to the tidal creeks. Cordgrass flowers between July and September, with alternating spikes at the end of the central, hollow stem. The tall form, usually found in the low marsh and on creek banks can grow to 6 feet, while the short form, usually found near pools in the high marsh, is less than 1.5 feet.

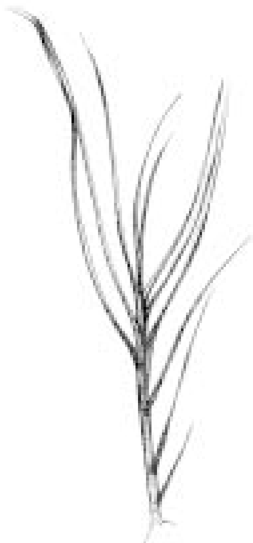


Black Grass
Juncus gerardii

Salt Meadow Hay, *Spartina patens*, is a perennial salt marsh grass with fine stems and very narrow leaves that are rolled at the edges. Salt Hay is found in the irregularly flooded ***high marsh*** habitat, at a higher elevation than Cordgrass. It flowers between late June and October with 3 – 6 alternating spikes at the end of a stiff, hollow stem. It typically lies flat, forming "cowlick" patterns in the high marsh. Can grow to 3 feet.

Salt Meadow Hay
Spartina patens

Black grass, *Juncus gerardii*, while having the appearance of a grass, is in fact a perennial rush that inhabits the high marsh. It generally has one or two fine, narrow leaves that are rolled at the edges. Black Grass flowers between June and September with a dense flower cluster at the top of the central stem; the flower will produce distinctive, dark, rounded seeds. Another *Juncus* species, *Juncus balticus*, is also found in Maine. The central distinguishing feature between these two species is that the *J. balticus* flower cluster is located in the middle of the main stem, while *J. gerardii's* is at the top. Can grow to 2 feet.



Spike Grass
Distichlis spicata

Spike Grass, *Distichlis spicata*, is a perennial salt marsh grass that grows in the high marsh with Salt Meadow Hay and can sometimes be confused with it. The main distinguishing feature of spike grass is leaves growing at regular intervals from the stiff hollow stem, where salt hay has no such pattern. Spike Grass flowers between August and October with short flower heads that produce seeds on both sides of the head. Can grow to 16 inches.

Common Reed, *Phragmites australis*, is a true grass with broad, alternating leaves and a large, plume-like flower along a tall, (up to 12 feet) stiff, hollow stem. The reed occurs naturally along the upland edge of salt marshes where freshwater inputs reduce the ***salinity*** (i.e., brackish conditions). Often, human alterations of tidal exchange and of the marsh surface (e.g. roadbeds) create conditions that allow *Phragmites* to become invasive, forming dense stands that crowd out Salt Meadow Hay and other native species of the high marsh.

Common Reed
Phragmites australis

Glasswort
Salicornia europaea

Glasswort, *Salicornia europaea*, is a distinctive, annual, pioneer species that grows primarily in bare patches created by natural (e.g., ice) or human (e.g., trampling) disturbance. Glasswort has a fleshy, (succulent) branching structure with scales that wrap around the stems, creating a segmented appearance. During spring and summer it is green in color, turning to red in fall. Grows 4-20 inches tall.

IF THEY ARE SO VALUABLE, WHY ARE MANY SALT MARSHES IN TROUBLE?

Cultural changes led to the devaluation of this natural resource.

Before European settlement, Native Americans depended on Maine's salt marshes as bountiful hunting, fin- and shellfishing grounds. Early settlers also relied on salt marshes for hay and pasture for their livestock, altering the marshes with ***dikes***, berms and ditches in an effort to grow more hay. During the industrialization and urbanization of the 19th century, the public's perception of salt marshes was transformed from seeing them as valuable resources to thinking they were dank, soggy barriers to development and sources of disease. As a result, salt marshes were:

- filled for the disposal of human garbage and waste
- diked, ditched and drained for conversion to agricultural land
- restricted or blocked from the tide by railroad and highway embankments
- ***dredged*** for navigation
- filled with ***dredge materials***
- ditched with the intention of eliminating temporary, standing water on the marsh
- damaged or destroyed by residential and commercial development, especially after World War II when population and recreation in the coastal zone began increasing dramatically

The vitality of Maine's tidal wetlands has declined significantly as a result of these impacts and disturbances.

Thousands of acres of productive shellfish beds have been closed to harvesting due to poor water quality. Finfish and waterbird populations have been dramatically affected due, in part, to the alteration and/or loss of breeding and nursery habitat.

Physical alterations such as dikes, culverts, berms, fill and ditches alter tidal ***hydrology***, resulting in:

- marsh ***subsidence***; lower marsh elevation increases the threat of flooding and erosion of uplands and conversion of marsh to open water
- invasion of non-native plants, such as Common Reed, which alter habitat for native species, obstruct views and pose a fire hazard
- conversion of many hundreds of acres to ***freshwater marsh***, which alters the diversity and resilience of the estuary
- the loss of migratory fish passage between fresh and saltwater habitats
- impacts on water table and tidal patterns
- changes in surface water on the marsh

Background photo by Randy Spencer, Atlantic Salmon Commission

Small-scale impacts continue to threaten salt marshes.

Large-scale destruction, filling and dredging of salt marshes are now virtually prohibited by law. But the damage from past actions remains and the cumulative effects of small-scale impacts continue to threaten salt marshes. For example, development near marsh edges creates the risk of increased freshwater ***runoff***, ***sedimentation***, and pollution by disease-causing agents, excess nutrients and contaminants. It can also adversely affect fish, wildlife and other organisms that use salt marshes.

Also, ***hardening*** of the upland edges of salt marshes can prevent their ***migration*** upward and inland in response to rising ***sea level.*** Salt marshes bounded by seawalls are prevented from retreating and will eventually drown as the sea rises around them.

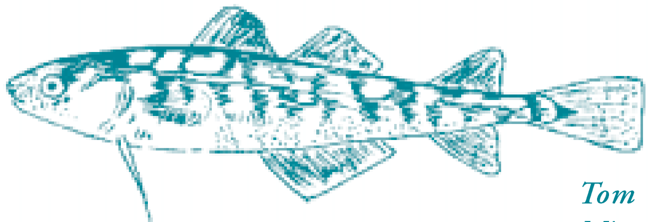
WHAT CAN BE DONE TO IMPROVE DEGRADED SALT MARSHES?

Salt marshes that have been lost to development, filling, draining or dredging may never be replaced. However, many acres of degraded marsh in Maine can be restored.

In ecological ***restoration***, we seek to return an ecosystem, as closely as possible, to its structure and function prior to ***human disturbance***. Its goal is to develop a self-sustaining ecosystem that resembles the structure and function of a natural system. Because each marsh system is unique, goals for structural and functional change in the marsh system must be defined, and restoration measures must be carefully crafted to ensure that the goals for the system are achieved. In the case of salt marsh restoration, there are numerous strategies that are now being used in the Gulf of Maine. These include:

Restoring tidal flow: A salt marsh's link to the sea may be completely cut off by a dike or ***levee***, or an undersized ***culvert*** or ***tide gate*** may prevent adequate tidal exchange. Removing, resizing or reengineering these barriers reconnects marsh areas to natural tidal ebb and flow and provides the conditions the plants need to thrive. For example, in areas with nearby low-lying development, the possibility of flooding may be a community concern. In this case a ***self-regulating tide gate*** that automatically limits maximum tidal levels may provide the assurance needed.

Photo by Marilee Lovit



Tom cod
Microgadus tomcod

Removing tidal restrictions: A number of migratory fish species in the Gulf of Maine (e.g. shad, river herring, sea-run salmon and trout, rainbow smelt, tom cod, and eel) must travel back and forth from salt water to fresh water to complete their life cycles. Salt marshes provide pathways that link marine and fresh water for these species and also provide an important staging area for the fishes to feed and prepare for migration. Other marine fishes use marshes as important feeding areas. ***Tidal restrictions*** can greatly hinder or entirely prevent fishes from accessing salt marsh food resources.

Restoring vegetation: In many cases, restoring tidal flow will eventually create the conditions that are needed for salt marsh plants to re-colonize on their own, but this is a slow process taking up to 20 years or more. If the affected marsh is overrun with ***invasive plants***, such as Common Reed, then mowing, cutting, herbicide application or prescribed burning may be needed as an additional management tool. This could provide an opportunity for ***Spartina*** to return, or replanting may be used to ensure the ***recolonization*** of native grasses.

Correcting marsh surface alterations: Changes have been made in Maine salt marshes since Europeans settled here. Changes include: diking to convert to upland; ditching to enhance harvest of salt marsh hay; and later, ditching intended to drain standing water from the marsh or to drain storm water from developed uplands. Roads were built across the marshes. Marshes were used to deposit dredge materials. The relative impact of each alteration within a marsh system can vary with its location and degree of natural recovery.

WHO CAN HELP RESTORE SALT MARSHES IN MAINE?

YOU and other concerned members of your community are crucial partners.

To be effective, salt marsh restoration efforts need strong support from local individuals and groups committed to making a difference. Working with conservation groups and local, state and federal agencies as partners, you will find a wealth of knowledge and resources available to:

- preserve healthy salt marshes; preventing damage before it begins is the most effective and least costly means of habitat protection
- stop further damage to impacted salt marshes in your community
- support habitat restoration efforts at any stage in the process from project planning and community education, to implementation assistance and ongoing stewardship and ***monitoring***

SUPPORT FOR YOUR WORK

Resource people in Maine who can facilitate your local restoration work can be found at all levels, from municipal officials, university extension and non-profit organization staff, to state and federal agency personnel.

To be connected with the resource person who is best able to meet your needs, start by contacting ***Maine's Habitat Restoration Coordinator:***

Jon Kachmar
Habitat Restoration Coordinator / Gulf of Maine Program
Maine Coastal Program
Maine State Planning Office
38 State House Station
Augusta, ME 04333-0038
207-287-1913 (voice)
207-287-8059 (fax)
Toll-free in ME: (800) 662-4545
Email: jon.kachmar@maine.gov
Web site: http://www.maine.gov/spo/mcp/

RESOURCES FOR FURTHER INQUIRY

The Ecology of Atlantic Shorelines. Bertness, Mark D., 1999, Sunderland, Mass, Sinauer Associates, URSUS CALL #: QH104.5.A84 B47 1999, ISBN: 0878930566.
A clearly written, introductory college level textbook.

Global Programme of Action Coalition for the Gulf of Maine: Regional Standards to Identify and Evaluate Tidal Wetland Restoration in the Gulf of Maine. Commission for Environmental Cooperation. http://www..pwrc.usgs.gov/resshow/neckles/gpac.htm
Summary of regionally-accepted standards for salt marsh restoration site selection and monitoring.

An Introduction and User's Guide to Wetland Restoration, Creation, and Enhancement. NOAA/EPA 2003. *Web versions to be posted at:*
www.nmfs.noaa.gov/habitat/habitatprotection/wetlands.htm

Invasive Plants (Search for Phragmites, Purple Loosestrife): http://www.invasiveplants.net/
Extensive material on invasive plants.

Maine's Coastal Wetlands: I. Types, Distribution, Rankings, Functions and Values. Ward, Alison. 1999. Maine Department of Environmental Protection, Augusta, ME
http://www.state.me.us/dep/blwq/doccoast/coastal3.htm
Survey and description of coastal habitats for regulatory purposes.

New Hampshire Marsh Manuals on marsh ecology, monitoring, evaluation and restoration:
http://webster.state.nh.us/coastal/Restoration/salt_marsh_monitoring_in_new_ham.htm
http://webster.state.nh.us/coastal/Restoration/SaltmarshPlantFieldGuide-PDF2.pdf
http://www.nh.nrcs.usda.gov/technical/Ecosystem_Restoration/salt_marsh_NH.html

Restoration Primer. Society for Ecological Restoration. 2002.
http://www.ser.org/Primer.pdf
Introduction to the philosophic basis for restoration.

Return the Tides Resource Book. Bonebakker, Erno R., Peter Shelley, and Kim Spectre. 2000, Conservation Law Foundation, Rockland, ME.
http://www.transitterminal.com/wetlands/
A primer on tidal marsh ecology and restoration and protocols for tidal restriction inventory.

Topographic maps, aerial photos or nautical charts:
Maine Department of Marine Resources coastal air photos (1995):
http://www.state.me.us/dmr/aerialphotos/
Maptech: http://www.maptech.com/index.cfm Click to ONLINE MAPS then MAP SERVER.

GLOSSARY

Algae: Very simple plants (ranging in size from microscopic plankton to meters-long kelp) that are either attached or unattached in aquatic (marine or freshwater) environments.

Algal Bloom: The rapid proliferation of algae in water.

Community: A group of species inhabiting a given area, where organisms interact and influence one another's distribution, abundance and evolution.

Culvert: An enclosed channel or conduit to direct a waterway under an embankment, road, etc.

Dike: An embankment acting as protection against flooding or to exclude water.

Dredge: Removal of sediment from waterways, usually to improve navigation.

Dredge Material: Sediment removed from waterways during the process of dredging.

Ecosystem: A community of plants and animals and the physical environment they inhabit (such as tidal wetlands), which results from the interactions among soils, climate, plant life and animal life.

Estuary: Region of transition between freshwater rivers and nearshore ocean waters, where tidal action and river flow mix fresh and salt water. Such areas of brackish water can include bays, mouths of rivers, salt marshes and lagoons.

Finger Marsh: A marsh with an elongated main channel that is narrow relative to breadth of the high marsh. See ***fringe marsh.***

Food Web: The multiple linkages between food chains in a community of organisms.

Freshwater Marsh: A vegetated wetland with salinity between 0 and .5 parts per thousand.

Freshwater Tidal Marshes: Marshes that are tidally influenced, but where the average water salinity is less than 0.5 parts per thousand.

Fringe Marsh: An elongated marsh with marsh area small compared to size of the adjacent water body. Limited high marsh development. See ***finger marsh.***

Habitat: The environment in which the requirements of a specific life stage of a plant or animal are met; the place where an organism lives.

Hardening: The construction or reinforcement of stabilizing structures along a habitat edge that is subject to erosion, such as the perimeter of a salt marsh.

High Marsh: Areas of tidal marshes that are flooded on higher than average high tides and are typically dominated by Salt Meadow Hay (*Spartina patens*).

Human Disturbance: Activity or condition caused, directly or indirectly, by humans that interrupts the natural state of ecological relationship and function.

Hydrology: The study of the water of the earth, its occurrence, distribution and circulation with particular emphasis on water's movement and physical/chemical properties.

Invasive Plants: Plant species that, when introduced to an ecosystem, can disturb the existing community and habitat structure by invading and dominating the natural plant community, frequently establishing dense, monotypical (single species) stands of vegetation.

Levee: An embankment preventing overflow from a watercourse.

Low Marsh: Areas of marsh that are flooded by all high tides and are dominated by Cordgrass.

Marsh Border: The zone of a salt marsh that is only flooded during extreme high tides or coastal storms, sustaining a variety of upland and wetland plants that are not well adapted to periodic flooding or salt stress.

Migration of the Shoreline: Over geologic time, the movement of sand, dunes, salt marshes and forests seaward or landward in response to changing ocean levels.

Monitoring: Periodic or continuous surveys or sampling to determine the status or condition of various media and systems, including water bodies, groups of plants and animals or ecological systems.

Peat: The organic soil formed by the accumulation of dead marsh plant material and sediments.

Recolonization: Reoccupation by a plant or animal of an area where it was previously absent.

Restoration: Efforts to return an ecosystem as closely as possible to its flora, fauna, structure and function prior to disturbance.

Runoff: Water from precipitation or snow melt that flows over a land area into streams and rivers.

Salinity: The relative concentration of salts in a given water sample expressed in terms of parts per thousand (ppt). The salinity of seawater is approximately 34 ppt.

Salt Marsh: Vegetated intertidal wetland characterized by emergent grasses with salinity between 18 and 34 parts per thousand.

Salt Marsh Pools: Shallow ponds that form on the surface of the marsh and hold salt water between tides.

Sea Level: The level of the surface of the ocean at its mean (average) position between high and low tide.

Sea Level Rise: The rising level of the ocean in relation to dry land over the last 11,000 years, corresponding with the rising temperature of the earth's atmosphere. In the next 100 years, sea level is expected to rise between 0.5 and 3 feet.

Sedimentation: A geologic process involving the deposition of material in the form of sediment.

Self-regulating Tide Gate: A float-activated water control structure that permits two-way flow up to a predetermined tide level (set point) and prevents tidal flooding above the set point.

Spartina: The name used to collectively describe the two dominant grasses of the salt marsh that thrive in areas with regular tidal flooding; *Spartina alterniflora*, or Cordgrass, in the low marsh and *Spartina patens*, or Salt Meadow Hay, in the high marsh.

Storm Surge: The rise of ocean water above normal onshore levels due to the action of wind on the surface.

Subsidence: The sinking of the marsh surface, through compaction or degradation of marsh peat; often occurs when Salt Meadow Hay (*Spartina patens*) is deprived of tidal flow.

Tide Gate: An opening through which water may flow freely when the tide sets in one direction, but which closes automatically and prevents the water from flowing in the other direction.

Tidal or Flow Restriction: A structure or landform that restricts natural tidal flow, such as a dike, tide gate, culvert, bridge, dam or causeway.

Transition Zone: Area surrounding a wetland where conditions gradually change from those supporting wetland organisms to those supporting upland organisms. See ***marsh border***.

Upland: Land lying above the level of flooding by spring high tides, including habitats such as forests or grasslands.

Upland Islands: Areas of upland soils and vegetation located within a tidal marsh.

Watershed: A land area within which all flowing water drains into one common water body such as a river, lake, estuary or ocean inlet.

Wetland: A wet habitat that forms a gradient between terrestrial and aquatic systems where the water table is usually at, or near, the surface or the land is covered by shallow water.

Zonation: The observed distribution of New England salt marsh plant species into distinct patches or zones due to tidal flooding, salinity and species interactions. Progressing across the marsh from low to higher areas, the typical zonation includes low marsh, high marsh and border or fringing marsh.

WORKING IN PARTNERSHIP WE CAN:

Increase the community's understanding of the values and functions of salt marshes as essential resources linking upland and marine habitats

Preserve the integrity of our remaining healthy salt marshes

Restore the vitality of salt marshes degraded by human activities

Protect an important landscape link to our coastal heritage

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